

Math 335-002
Homework #1

Due date: Monday, January 22, 2007

Please show all work in detail to receive full credit. Late homework is not accepted.

1. Classify the following quantities according to whether they are vectors or scalars: magnetic field strength, energy, mass, acceleration, air pressure, electric charge.
2. If $\vec{a} = (1, -2, 2)$ and $\vec{b} = (0, 3, 4)$, find $|\vec{a}|$, $|\vec{b}|$, $\vec{a} + \vec{b}$, $\vec{a} - \vec{b}$, $\vec{a} \cdot \vec{b}$, and $\vec{a} \times \vec{b}$. Find the angle between vectors \vec{a} and \vec{b} (this may require a calculator).
3. For the two vectors of problem 2, find the component of \vec{a} in the direction of \vec{b} , and the component of \vec{b} in the direction of \vec{a} .
4. Use vector algebra to show that the diagonals of a rhombus are perpendicular (a rhombus is a parallelogram with sides of equal length).
5. Find the angle between the diagonal of a cube and one of its edges. Make a sketch to illustrate the problem (it may be useful to go over the problem 1.6 on page 8).
6. Find the equation of a line passing through points $(0,1,0)$ and $(2,0,0)$, in the vector form, $\vec{r} = \vec{a} + \lambda \vec{b}$, where λ is any real number (a parameter). Make a sketch. (Hint: you've learned this in Calculus III)
7. Draw vectors \vec{a} and \vec{b} that satisfy the condition $|\vec{a} - \vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2$
8. Express the following formulas in terms of the vector lengths and the angle between the vectors; simplify if possible:
 - a) $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2$
 - b) $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$
 - c) $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b})$